MAINTENANCE NOTE XX (for Data Acquisition Program Managers)

DRAFT

SUBJECT	: Primary Surge Protector, **C460-5**, Installation Instructions
PURPOSE	: Use and installation instructions for new Stock Item
EQUIPMENT AFFECTED	: Used with: C450-1, C450-7 : MMTS Displays C451-N1 : Nimbus PL-2 Display C450-2 : MMTS thermistor and shelter Replaces: C450-5: ACMMTS Primary Protector Assembly C450-6: ACMMTS Stainless Steel Primary Protector C460-1: Sensor Line Clamp C460-3: MOV Assembly C460-4: Surge Protector, Verite
PARTS REQUIRED	: See Appendix A
SPECIAL TOOLS REQUIRED	: Small, Flat Bladed Screwdriver
MODIFICATION PROCUREMENT	: None
EFFECTIVITY	: All MMTS and Nimbus Sites
ESTIMATED TIME REQUIRED	: 4 hours
EFFECT ON OTHER INSTRUCTIONS	: None.

GENERAL:

This maintenance note provides Data Acquisition Managers (DAPM) the installation instructions for the primary protector assembly (PPA) surge protection for the NWS Thermometer Display units (TDUs). The PPA is to be installed in the sensor line between the thermistor/shelter (beehive) and the various temperature display units (TDU). The PPA must be installed outside, to stop surges before they enter the facility.

PROCEDURE:

The instructions and procedures for installation lightning protection circuitry are attached.

REPORTING INSTRUCTIONS:

Report completed modification via CSSA, Site Maintenance Record, using the instructions in Directive XX-xxxx, Section ????. Include the following information in the report:

Equipment code of ???? in block Y
Modification number as XX in block YY
Reason for change in Remarks

A sample Report is provided as attachment B.

Attachment A	Primary Surge Protector Circuitry Installation Instructions
Attachment B	Maintenance Report Sample

Attachment A
Primary Surge Protector Installation Instructions

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Primary Protector Assembly Installation

Purpose

This plan, includes an installation scheme to provide surge protection on the sensor line as it enters the building for the temperature display units (TDU): the MMTS and the Nimbus PL-2. This plan follows the guidelines set by the National electrical Code (NEC) and the NOAA Directive NWSM 30-4106, Lightning Protection, Grounding, Bonding Shielding, and Surge Protection Requirements.

Effective surge protection requires the existence of an effective grounding system. All facilities and residences in the US that use AC power are required to have a grounding system. This plan will show you how to identify and use that grounding system. If, upon inspection, the proposed monitoring site does NOT have a grounding system, this site will be abandoned.

This plan is focused on installations at residences, but is applicable to all facilities. This plan uses the grounding system of the Service Entrance Panel (SEP) and will hereafter be referred to as an SEP plan. The SEP plan provides maximum protection for the TDUs, the observer, and the facility. See Figure 1 for an overview. The entry of the data lines near the SEP enables the best arrangement for grounding the primary protector assembly (PPA) to the facility ground. This optimum grounding provides the least risk of shock, arcing, and surge damage.

NOTE: If the facility AC service entrance power panel does not use an external ground rod or connection to a metal cold water piping system, effective surge protection cannot be established and this site must be abandoned.

Effectively

The SEP installation is required at all new sites and at any site that requires replacement of the existing primary protector.

Reason For Change

The Verite surge protector, used in C450-5 and 6 series of protectors, is no longer available commercially. The NLSC stock numbers that reference the Verite protector will be deleted upon depletion.

A Service Entrance Panel (SEP) Plan Installation

General

All new and upgrade TDU installations are to be installed so the Primary Protector Assembly (PPA) is in close proximity to the facility AC power SEP. A primary protector assembly (PPA) is to be installed outside the facility at this point. The PPA is to be grounded to the facility ground. The rigid, buried, cable from the thermistor sensor is terminated on the IN side of the PPA. From the OUT side of the PPA, the flexible indoor cable is routed into and through the facility to the TDU. See Figure 1 for a typical installation, and Figures 2 and 3 for a typical facility entrance hole and PPA wiring.

The remainder of this instruction provides the details of the installation. The installation list of materials (LOM), Appendices 2 and 3, should be reviewed to ensure that all necessary materials are available. Some materials are site specific and cannot be identified until the site has been visited and the installation details determined.

Precedence: The protector installed by the telephone company on the phone lines is similar to the installation of the PPA on the TDU sensor lines. If the installation of the phone service wiring at a particular site has been done by a commercial company, it could serve as a reliable overview of the installation of the PPA.

NOTE: Installation of other similar systems such as cable TV, satellite dishes and TV antennas shall not be used as examples.

References: The National Electric Code (NEC), 1987, was used extensively in developing this plan. While the NEC does not expressly cover this particular type of installation, this plan complies with the intent of all appropriate sections. The following references are to aid in answering questions regarding code compliance:

The section of the NEC that best applies to this application is Article 800, Communication Circuits. Grounding system, bonding, and connections to grounding system are covered in Article 250. Of particular importance to this installation are, Section G, Bonding; Section H, Grounding Electrode System; and Section K, Grounding Conductor Connection.

PPA Installation

Pre-installation Planning

NOTE:	This is the most important step in the installation.

1. Identify the ground point for the protection system. Care in identifying the proper ground point is the best way to assure trouble free and effective PPA operation. The PPA must be grounded to the facility or building grounding electrode system. The grounding electrode system is basically the building ground or ground system. The electrical service panel will, in all cases, be connected to the grounding electrode system by a grounding wire, called the *grounding electrode conductor*. In most residences, the grounding electrode system or house ground is connected to the an external ground rod or a metal cold water piping system. A thick bare ground wire (the *grounding electrode conductor*) connected between the service panel and the external ground rod, or cold water piping, will confirm the existence of a grounding electrode system.

   If a pre-existing grounding electrode *conductor* can not be found, this site will be abandoned. The ground lead from the PPA must connect to the grounding electrode *conductor* of the facility. Do not connect the ground lead from the PPA directly to the cold water piping or the ground rod. Do not, under any circumstances, install a second ground rod.

NOTE:	The CPM is not to install the facility grounding electrode conductor! if available, it will have been previously installed by the certified electricians that wired the facility. The CPM is not to install any connection inside or to the circuit breaker panel or the service entrance panel! The CPM is not to install a ground rod.

   If the building grounding electrode *conductor* cannot be positively identified, or if there is reason to doubt the quality of the ground, the advice of a qualified electrician (licensed for your county) must be obtained.

   If a ground rod and a cold water ground are found at the facility, connect the PPA grounding conductor to the grounding electrode conductor going to the ground rod. If at all possible, make the ground connection OUTSIDE the facility.

2. Select the PPA installation location and sensor cable entrance points. Install the PPA to provide the shortest straight line grounding cable run to the grounding point selected above. It is preferable to run the sensor

cable all the way around the facility (not through) over using a grounding cable longer than 15 feet.

After selecting the ground point, mount the PPA nearby. The PPA should not be installed on a conductive surface to prevent flashover in the event of a direct lightning strike. Use an appropriate saddle or grounding clamp for the wire sizes involved and securely clamp the PPA ground wire to the facility's grounding electrode *conductor*. The end of the PPA ground wire should point toward the ground, away from the SEP. Dress the PPA ground wire so there are no right angle bends and no loops, striving to make any required bends no tighter than a 1 foot radius (larger is better). Secure the PPA ground wire to the facility wall with NON-metallic cable clamps. Use fasteners appropriate for the mounting wall.

The installation must maintain at least 1 foot separation between the cable from the sensor and the cable to the display, except where they enter the PPA. Routing the display cable through exterior aluminum siding is permissible if done through an insulating bushing or plastic pipe as shown in Figure 2 to prevent chaffing.

Installation

I. Mount the PPA at a location near the SEP.

II. Mount the bonding or saddle clamp to the grounding electrode conductor.

III. Make a slanted opening in the facility structure at the cable entrance point. Slant the opening to prevent entry of water from the outside, as shown in Figure 2, installing the insulating bushing, if required.

IV. Extend the indoor cable from the display location, through the entry hole, and to the vicinity of the PPA. Seal the entry hole on the outside and inside with caulk. Install caulk so the cable is not touching the entry points to reduce possible cable chaffing. Support the cable run with appropriate clamps. Do not use metal staples on the sensor or display cables.

V. Route the display, sensor and ground cables to the bottom of the PPA. Do not run the display, sensor, or grounding cables together or parallel for any distance, fan then out as they exit the PPA. Maintain the required 1 foot minimum spacing between the sensor and display cables right up to the entrance of the PPA. The Ground cable run is the critical one - it's run must be short, as straight as possible and without tight bends. The sensor cable is the next most critical, route it to the PPA without sharp bends and not crossing the ground cable or display cable. The display cable can have sharp bends, must be routed away from the other two cables and must not cross the other two cables. Fasten all cables to the wall with non-metallic clamps to maintain their positions. Puncture the center of the cable entrance seal of the PPA and push all three cables through the seal.

Striving to leave minimal extra length inside the PPA, cut all three to length, and strip the outer jacket from the two mutli-conductor cables.

VI. Display Cable: Strip 1/4 inch from the two data conductors and bind one each in the first two screw clamp connections, (typically 5 & 6) of the low voltage (6V) OUT connector. Strip, if necessary, the drain wire, crimp on a spade or ring terminal, and attach to the large central ground post in the center of the box. Support the cable with a clamp near the PPA.

VII. Sensor Cable: Strip 1/4 inch from the two data conductors, and matching the order you used on the display cable (black to black, etc) bind one each in the first two screw clamp connections, (typically 5 & 6) of the low voltage (6V) IN connector. Strip, if necessary, the drain wire, crimp on a spade or ring terminal, and attach to the large central ground post in the center of the box. The drain wire connection is not optional, connect it to the ground post. Support the cable with a clamp near the PPA. Do not run the display cable near the sensor cable (minimum of one foot).

VIII. The ground wire must run straight from the threaded binding post out through the bottom of the PPA. There must be NO loops or extra length zig-zaged up inside the PPA. Carefully cut the ground cable to length, and crimp on a large spade or ring terminal, and attach it to the threaded binding post in the center of the box. Secure with a nut and lock washer.

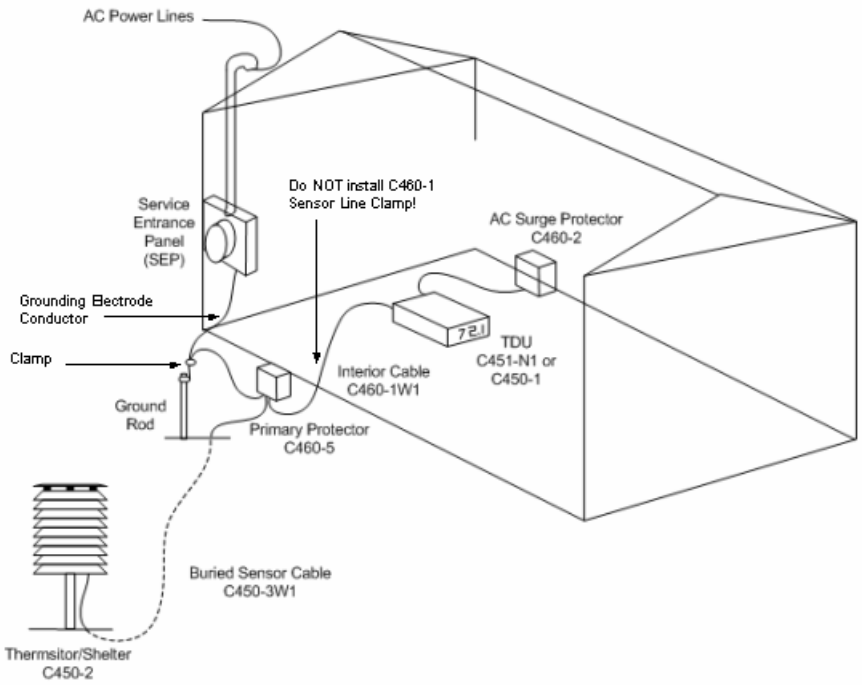

Figure 1 SEP Installation

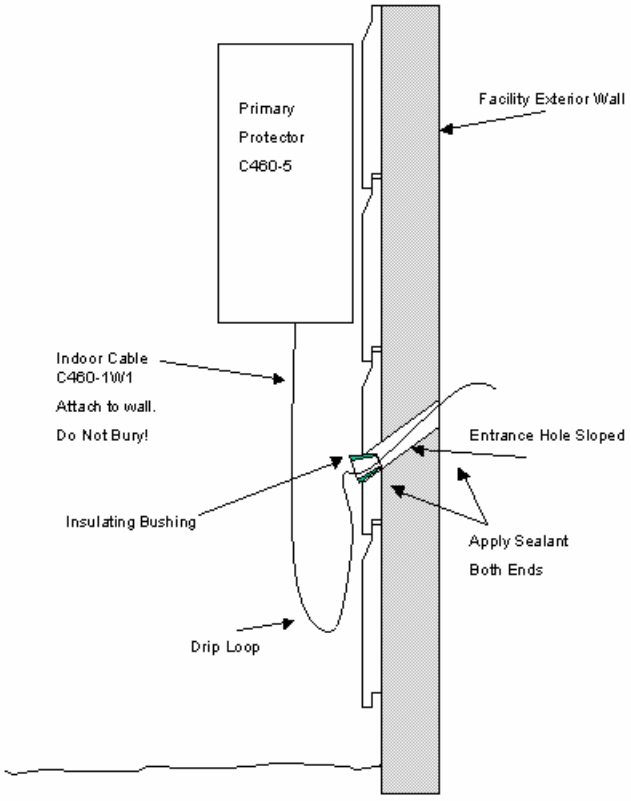

Figure 2 Cable Entrance Details

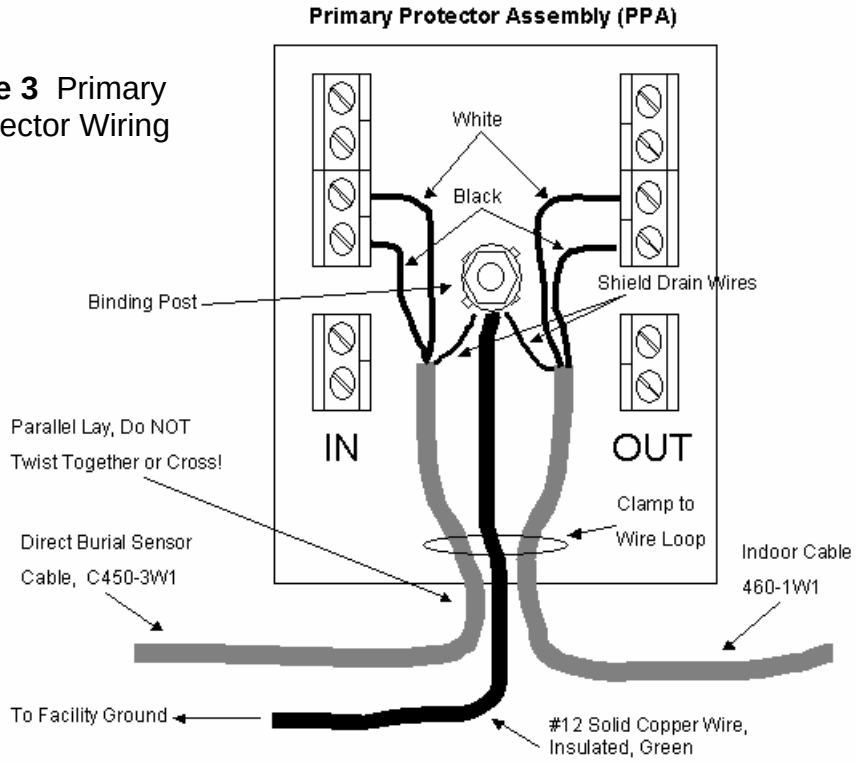

Figure 3 Primary Protector Wiring

Appendix 1
Ground Identification Guidance

The following, which is paraphrased from the National Electric Code (NEC, 1987), is provided as guidance in the identification and selection of a grounding point. If a grounding point cannot be positively identified, assistance from a qualified electrician (licensed for your county) must be sought, otherwise this site must be abandoned.

The building or structure grounding electrode system. The grounding electrode system, in general, consists of the following items (when available) bonded together by jumpers: metal underground water pipe, grounded metal frame of building, concrete-encased electrode, or ground ring. These bonded items will be connected to the service entrance panel (SEP) box by a grounding electrode conductor. In a residence, all this normally reduces to the metal cold water piping system or ground rod, which is connected to the service entrance panel by a *grounding electrode conductor*. Of the above items, when it is certain that they are part of the grounding electrode system, ONLY the *grounding electrode conductor* is suitable as the grounding point connection for the PPA. For example, if the cold water piping system is the grounding electrode system as indicated by its connection by *grounding electrode conductor* to the SEP, then a point on the grounding electrode *conductor* nearest the PPA is the proper grounding point.

The “power service accessible grounding point” defined by NEC refers to a cable or connection point that is external to the enclosure. The NEC (Section 250-71b) specifies that for dwellings, a provision for externally connecting grounding conductors to the enclosures is to be provided. In addition to the metallic power service raceway and the grounding electrode conductor covered in the NEC text, provisions for other approved ground points must be available. An example of the approved means is a #6 AWG copper conductor bonded to the service equipment and made accessible on the outside wall of the dwelling. [see NEC Section 250-71b (3)]. This auxillary ground point is not typically available in a residence, regardless, if the facility wiring complies with NEC, a grounding electrode conductor will be available for your use. Connect the PPA ground to the SEP grounding electrode *conductor*, ONLY.

The Metallic Power Service Raceway: Not normally used in a residence. Do not connect to a raceway. A reliable surge protection ground connection to a raceway can not be legally made without the services of a licensed electrician.

The Grounding Electrode Conductor or the Grounding Electrode Conductor Enclosure : (The conductor enclosure is not normally used in residences.) Connect to the grounding electrode conductor, only.

The Service Entrance Enclosure.: Do not connect to the service entrance enclosure. Under NO circumstances should you make a connection INSIDE the service entrance enclosure.

If a grounding electrode conductor can not be found, then this site may not have an effective ground and NWS electrical or electronic equipment will not be installed on the premises! Do not make connections to grounded metal structures, underground metal gas piping, steam or hot water pipes. Although some of these connections are allowed in NEC, NWS does not provide the training or equipment to determine the effectiveness of these items as a ground, nor does NWS have the resources to execute a complete site survey (search of building plans/records, utility records, county construction permits/inspections, etc) to make a determination in lieu of on-site measurements.

Appendix 2
List of Materials Available at NLSC

Primary Protector, ASN-C460-5
Connector AMP, 2 ea per package, C450-3P1
Connector Pin, 4 ea, for pins 1 and 3, C450-3P1MP1 (2 packages required for each new installation)
Cable Shielded, Exterior, 20 AWG, C450-3W1
Cable, Interior, 22 AWG, C460-1W1
Temperature Display Unit, Nimbus PL-2, C451-N1
Temperature Display Unit, Nimbus PL-2, 12 VDC power supply, C451-N1-PS1 (replacement item only, one is provided with each Nimbus PL-2)
Shelter/Thermistor, C450-2
AC surge protector, C460-2, for the AC power connection of the Nimbus

Appendix 3
Material Provided by Installing Activity

Ring or Spade lug for #20 and #22 AWG wire, crimp on type, #10 stud size. Used to connect shield wire of cables to ground stud in PPA.

Ring or Spade lug, for #12 AWG wire, crimp on type, #10 stud size. Used to connect ground wire to ground stud in PPA.

Copper wire, #12 AWG, solid insulated, green or green with yellow stripe, standard house wiring acceptable. PPA ground conductor.

Cable clamps, i.e. Radioshack White Single-Cable Nail-In Coax Clips **278-1659**

Ground clamp, split bolt type, sized for the grounding electrode conductor and #12 AWG wire. If the grounding electrode conductor is aluminum, the clamp must be suitable for both aluminum and copper.